

A FLIGHT EXPERIMENT FOR THERMODYNAMIC MEASUREMENTS NEAR THE LIQUID-GAS CRITICAL POINT OF ³He

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Abstract

We are now in the process of developing a NASA microgravity flight definition experiment called "MISTE" (Microgravity Scaling Theory Experiment). This experiment is being designed to perform specific heat at constant volume, C_V , and susceptibility, χ_T , measurements throughout the critical region of ³He to test scaling theory predictions. The latest theoretical predictions for the expected behavior of C_V and χ_T will be presented. Measurements of these parameters over a wide temperature and density range are now in progress. Gravity effects will significantly affect the measurements close to the critical point ($|t| \leq 1 \times 10^{-4}$). However, farther from the transition, we plan to use high precision measurements to determine the leading non-universal amplitudes in the correction to scaling region. An electrostriction technique was recently developed to measure the susceptibility along the critical isochore very close to the critical point. Unexpectedly long equilibrium time constants were observed. A possible explanation for these long time constants as well as experimental approaches to reduce the equilibration time will be discussed. Farther away from the transition, the susceptibility along the critical isochore will be determined from pressure-density measurements at constant temperature. This approach will also be used to measure the susceptibility along isotherms including the critical isotherm. Recent experimental data for these two susceptibility techniques will be presented.